Encouraging Public Transportation Through Effective Land Use Actions

METRO

May 1987

ACKNOWLEDGEMENTS

This document was prepared by staff of the Service Planning and Market Development Division. Eileen Kadesh (Market Development Planner), under the supervision of Rick Walsh (Manager, Service Planning and Market Development) and Bill Roach (Supervisor, Market Development) was the principal author. The project was begun under the direction of Martin Baker (Supervisor, Capital Program Management).

Special appreciation is extended to Jack Lattemann (Capital Planning and Development) for his painstaking review and extensive suggestions. Bob Harvey and Rob Fellows (also of Capital Planning and Development), Bob Simpson (Research and Market Strategy), John Shadoff and Candace Carlson (Sales and Customer Services), and Catelin Williams (Service Planning and Market Development) also provided helpful comments.

Other individuals who assisted in preparation of the manual include Collin Tong, Communications, and Lea Clark of Graphic Design.

Thanks to all the Metro staff who cooperated in this effort!

Ronald J. Tober
Director of Transit

INTRODUCTION

This document is a companion to Metro's Transportation Service Guidelines, which describes the conditions for establishing and evaluating new and existing transportation services, and the Metro Transportation Facility Design Guidelines, which provides information on the standards used by Metro in the design of transit and ridesharing facilities. It provides information for local planning staffs on the effects of land use decisions on public transportation service and provides guidelines for the private sector on how to design new projects to be compatible with public transportation. A short summary of each section and its objectives can be found on pages vii-xi.

Coordination between land use and public transportation should occur at the following levels in the land use planning process: 1) comprehensive plan policies, 2) zoning ordinances, and 3) the environmental review and building/site plan review process. Since funds for public transportation services are limited, there needs to be a better understanding of what factors are involved in distributing these services and what actions local communities can take to promote conditions which can support higher service levels. At the federal level, the Urban Mass Transportation Administration has called upon local jurisdictions and the private sector to assume a greater role in the provision of public transportation services. Consequently, a need exists for local jurisdictions and the private sector to assist Metro in developing markets for transit and ridesharing as well as establish street networks that allow reasonably direct transit service to local communities.

Benefits to transit and ridesharing from closer coordination between public transportation and land use planning are:

- Higher transit ridership and auto occupancy;
- Lower transit operating costs;
- Improved access for transit vehicles; and
- Increased financial support for public transportation through public-private sector partnerships.

Local jurisdictions benefit through:

- o Reduced demand on roadway capacity;
- o Improved access to activity centers and greater mobility for residents;
- o Reduced parking needs; and
- o A more pedestrian-oriented environment.

Benefits that can be realized by the private sector when public transportation is considered in the initial design stages of a new project include:

- o Reduced parking needs, which translate into cost savings;
- o Greater marketability of the project;
- o Fewer delays in the development review process, with attendant cost savings; and
- o Increased chance of project approval.

There are also benefits to the public. These include:

- o Higher levels and quality of service within a fixed budget;
- o More transportation options; and
- o Environmental benefits.

This manual will examine some of the most effective land use tools and transportation management approaches that have been developed to enhance the use of public transportation. We will also evaluate their impact and suggest how local governments and the private sector might incorporate such programs into the land use planning process.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SUMMARY OF CONTENTS

SECTION 1: The Role of Public Transportation

Highlights

- Traffic congestion is no longer limited to downtown areas.
- New trends have developed in response to suburban traffic problems: increased clustering and diversification of development within activity centers, cooperative financing, and use of non-conventional public transportation vehicles.
- The combination of rapid growth, decreased federal funding, and increased construction and maintenance costs have severely limited local road funds' ability to keep pace with needed capital improvements.
- The projected increase in high occupancy vehicles (HOVs) must occur by the year 2000 or demand on the regional highway system will become extremely critical.

Contents

Section 1 discusses:

- Underlying reasons for suburban traffic congestion.
- Metro's public transportation services.
- What future development patterns and growth in travel demand mean for local jurisdictions.
- How much of the travel demand can be expected to shift to HOVs to compensate for the shortfall in local roadway funding.
- Current estimates of transit mode split in selected local communities.

SECTION 2: Factors Considered in Planning Public Transportation Service

Highlights

- High densities, concentrated travel corridors, a growing economy, and strong central areas are conducive to good public transportation. Low densities, dispersed development, and weak central areas limit ridership.

- Transit and ridesharing can operate most efficiently between areas of high or medium density and residential areas in close proximity. Markets involving lower densities, long distances, or people with atypical commute patterns are better served by carpools and vanpools. Nevertheless, increasing sprawl hinders the effectiveness of all HOV modes.

Contents

Section 2 covers:

- Factors involved in planning productive transit service.

- Constraints limiting the extent to which service can be modified, many of which are within local jurisdictions' control.

- Actions local jurisdictions can take to support transit and ridesharing.

SECTION 3: Planning a Development Which is Compatible with Public Transportation

Highlights

- A compatible development is located in an existing built-up area and in close proximity to transit, can potentially generate transit and rideshare trips, and provides quality pedestrian access.
- Transit service is closely interrelated with population and employment density.
- Increased population densities along existing transit corridors increase transit productivity.
- Building site layout and street patterns play an important role in determining whether tenants or customers of a project will use transit.

Contents

Section 3 provides:

- Factors that make a development compatible with public transportation.
- Guidelines for population and employment density thresholds that support local transit service.
- Guidelines for practical walking distances to bus stops.
- Design features of building site plans that encourage tenants of a project to use public transportation.
- Considerations for accommodating transit when planning street networks.
- A public transportation compatibility worksheet for use by developers and local planners.

SECTION 4: Parking Management

Highlights

- Parking management can deal with on-street parking supply, off-street parking supply, pricing, fringe parking, and enforcement and adjudication.
- The possibility of lower parking construction costs might lead a developer to commit to transportation management actions in exchange for lower parking requirements.
- A local jurisdiction can grant parking reductions without being subject to spillover, by requiring a portion of the development site to be held in reserve in case additional parking is needed in the future.
- Elimination of free employee parking is an important step toward discouraging single occupant vehicle (SOV) trips and lowering development costs.
- For parking charges to encourage people to use transit or rideshare without adverse spillover impacts, there must be a ban on parking on residential streets or other nearby free facilities to guard against spillover.
- Minimum parking requirements in suburban King County are too high and should be reduced at least 18 percent.

Contents

Section 4 contains:

- A definition of parking management and its multiple objectives.
- Factors influencing parking demand.
- "Rule-of-thumb" costs for parking construction.
- A range of parking management strategies and cities where these strategies are being used.
- The concept of maximum parking requirements and conditions where they are appropriate.
- The concept of "flexible" parking requirements, including a means for allowing parking reductions without spillover parking.
- Factors affecting the success of fringe parking.
- Parking requirements by type of use in King County jurisdictions.
- Parking requirements for office, retail, and multifamily developments in local jurisdictions throughout the United States.

SECTION 5: Mechanisms for Incorporating Public Transportation Needs into the Development Review Process

Highlights

- Local jurisdiction planning staffs have an opportunity to incorporate public transportation needs at a number of steps in the planning process.
- In reviewing development site plans, Metro's major concerns are internal circulation and accessibility to public transportation.
- A variety of specialized zoning techniques can be adopted by local jurisdictions to bring about public transportation-oriented land use development.

Contents

Section 5 covers:

- Where to incorporate public transportation needs in the local planning process.
- What Metro looks for when reviewing SEPA documents.
- Special zoning techniques that can be adopted by local jurisdictions to bring about public transportation-oriented land use development.

Section 1:
The Role of Public Transportation

I. THE CHANGING ROLE OF PUBLIC TRANSPORTATION

Until recently traffic congestion was principally a downtown problem. That is no longer the case, however. Some of the worst traffic jams now occur outside the urban core on circumferential highways, in suburban centers, and on approaches to suburban office parks. People commuting from one suburb to another or driving from their suburban homes to a shopping center are as likely to run into heavy traffic as are commuters on their way downtown. If present trends continue, lack of suburban mobility may become the central transportation issue of the late 1980's.[1]

Nationwide, the number of work trips to central city areas fell by 4.5 percent between 1970 and 1980, while those to suburban jobs rose by nearly 15 percent.[2] Most forecasters expect this trend to continue throughout this century; they predict that the largest growth in highway travel will be in nonradial directions oriented toward dispersed suburban centers.[3]

There appear to be several basic reasons for this increasing traffic congestion:[4]

1. Lower fuel costs.

2. Higher auto ownership.

3. Suburban "megacenters" or large-scale mixed activity complexes which generate high volumes of traffic on fully developed highway networks; and

4. Widely dispersed origins and destinations ill-suited to conventional bus and rail transit.

Given existing land use trends, public transit can serve only a fraction of the total travel demand. Development of transit centers with schedule coordination can overcome this problem to some extent by making existing suburban services operate more efficiently. Expanding conventional transit to dispersed subregional centers will continue to be very costly, however, and future technological breakthroughs that will

markedly improve productivity appear unlikely. It is in such suburban settings that ridesharing will play an increasingly important role.

It is expected that the need for public transportation will grow. About 30 percent of our society will continue to depend on some form of transit or ridesharing. One element of this market, the elderly population, will increase substantially in the years ahead.[5] In addition to being served by fixed route transit, the elderly and handicapped market will be served by shared-ride taxis, dial-a-ride, and other specialized transportation services.

Congestion is also likely to increase in suburban areas since road expansion is expected to be minimal. While suburban areas are projected to grow by about 60 percent over the next 20 years, transportation system capacity (the road network) will not be able to keep pace with this growth.[6]

Several important trends are emerging in response to this transportation crisis:

1. Clustering and diversification of development within activity centers, which reduces the need for travel and enables these centers to be served more efficiently by transit.

2. Changes in the role of the public and private sectors regarding provision of public transportation services. Attention is shifting to the government as a facilitator or coordinator rather than the owner and operator of public transportation. "Cooperative financing," the notion that private developments must bear a larger share of the cost of public infrastructure, is gaining wider acceptance.

3. Greater use of non-conventional transportation service approaches, such as contracts with taxi operators, and operation of vanpool programs, shuttles, custom buses, and carpools, rather than total reliance on full-size buses.

Resolving the looming transportation crisis will require a new partnership between the private sector, local municipalities, transportation agencies and public transpor-

tation providers. Formation of such a partnership is already occurring in metropolitan areas throughout the country as well as in the Puget Sound area.

II. THE ROLE OF PUBLIC TRANSPORTATION IN KING COUNTY

A. Description of Metro Service Area

The Municipality of Metropolitan Seattle provides transit and ridesharing services to a 2,128 square mile service area. Metro's 1985 service area population was 1,346,400 with an annual transit ridership of 64.6 million.

In addition to transit services, Metro's ridesharing program directly serves about 10,000 people per year through the ridematch program and about 1,500 people per year through the vanpool program, with about 5 million shared passenger trips per year resulting from the ridesharing services. Metro's ridesharing activities include ridematching, operation of public vanpools, shared use vans, park-and-pool lots, and promoting employer/developer HOV parking.

B. King County Development Trends

King County's development trends reflect those of the nation as a whole, with population growth occurring much faster in dispersed suburbs than in the central city area. King County's 2000 forecast population of 1.64 million is nearly 30 percent greater than the 1980 population of 1.26 million.[7] Three-fourths of the population growth is projected to occur in unincorporated areas of King County and one-fourth in the suburban cities.[8] Seattle's share of the county population is expected to decline,[9] although the city's absolute population is expected to stabilize.

In contrast to population trends, most of the employment growth (80 percent) will occur in cities.[10] By 2000, more than half of all jobs will be in Seattle, and only one-sixth of the jobs will be in unincorporated King County.[11] Table 1 shows King County employment trends between 1980 and 2000.

Table 1

POPULATION AND EMPLOYMENT GROWTH
FORECAST FOR SELECTED KING COUNTY ACTIVITY CENTERS

		POPULATION			EMPLOYMENT		
		1980	2000	Percent Change	1980	2000	Percent Change
Tukwila	(TAZ 143)*	3,593	4,913	+36.1	20,930	42,257	+102.0
Sea-Tac	(TAZ 130)	815	880	+7.9	4,672	6,155	+31.7
Renton	(FAZ 4130)**	9,771	11,708	+19.8	31,152	32,591	+4.6
Bellevue CBD	(FAZ 4900)	1,010	4,363	+331.9	13,246	33,238	+150.9
Duwamish	(FAZ 5810)	1,303	701	-46.2	20,970	23,562	+12.4
First Hill	(FAZ 6111)	48,120	44,623	-7.3	38,800	45,038	+16.1
Seattle CBD	(FAZ 6010)	6,322	8,834	+39.7	93,648	136,937	+46.2
University District	(FAZ 6212)	34,895	35,132	+0.68	34,521	42,472	+23.0
Ballard	(FAZ 6310)	50,248	47,087	-6.3	16,204	18,606	+14.8
Northgate	(FAZ 6221)	30,293	31,650	+4.5	15,855	20,645	+30.2
Kent	(FAZ 3500/3600)	28,503	40,587	+42.4	30,888	46,029	+49.0

TAZ = Traffic Analysis Zone
FAZ = Forecast Analysis Zone

Source: PSCOG

With the 30 percent increase in population projected for King County between 1980 and 2000, more vehicle trips will ensue and greater pressure will be placed on local roadways, many of which are already at capacity levels.

To refer to the level of traffic congestion on a roadway, traffic engineers use the term "level-of-service." Level-of-service (LOS) is a qualitative measurement based on vehicle operating speed, travel time, traffic interruptions, safety, and driving comfort. LOS is described by a letter scale from A to F, with "A" representing the best service and "F" representing the worst service. Figure 1 illustrates the level-of-service concept.

In Bellevue, 45 intersections are projected to reach LOS E or below by 1990-1995 if no improvements are made in existing conditions.[12] By the year 2000, nine key intersections in the University of Washington business district are projected to reach LOS E or worse in the p.m. peak.[13] And, even with programmed improvements, five arterials on the Soos Creek Plateau in south King County are forecast to operate at LOS F daily by 1990, with between 30 and 100 percent more traffic than they were designed to handle.[14]

In addition to the increased number of trips, the average trip length is expected to increase from 7.7 miles in 1980 to 8.2 miles in the year 2000 because of declining densities of population and employment.[15] Between 1980 and the year 2000, population in the Puget Sound region is projected to increase 34 percent, while travel (measured by vehicle miles traveled) is projected to grow by 41 percent.[16]

Historically, either surplus highway capacity has existed or funds have been available to provide needed improvements for traffic growth. In the past few years, however, rapid growth, decreased federal funding, and increased construction and maintenance costs have severely impacted the ability of local road funds to keep pace with needed capital improvements.

Illustration 3-5. Level-of-service A.

Level of Service A describes a condition of free flow with low volumes and high speeds. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. On freeways average travel speeds near 60 mph generally prevail. (Volume to capacity ratio less than or equal to 0.6)

Illustration 3-6. Level-of-service B.

Level of Service B is in the zone of stable flow, with operating speeds beginning to be restricted somewhat by traffic conditions. Drivers still have reasonable freedom to select their speed. On freeways speeds of over 57 mph are maintained. (Volume to capacity ratio greater than 0.6 but less than or equal to 0.7)

Illustration 3-7. Level-of-service C.

Level of Service C is still in the zone of stable flow, but speeds and maneuverability are more closely controlled by the higher volumes. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. Average travel speeds on freeways are still over 54 mph (Volume to capacity ratio greater than 0.7 but less than or equal to 0.8)

FIGURE 1
Level-of-Service Illustration

Illustration 3-8. Level-of-service D.

Level of Service D approaches unstable flow. Speed and freedom to maneuver are severely restricted. Small increases in traffic flow will generally cause operational problems at this level. Average travel speeds on freeways are 46 mph. (Volume to capacity ratio greater than 0.8 but less than or equal to 0.9)

Illustration 3-9. Level-of-service E.

Level of Service E represents operating conditions at or near the capacity of the highway. Freedom to maneuver within the traffic stream is extremely difficult. Any incident can be expected to produce a serious breakdown with extensive queuing. Average travel speeds on freeways are approximately 30 mph. (Volume to capacity ratio greater than 0.9 but less than or equal to 1.0)

Illustration 3-10. Level-of-service F.

Level of Service F describes forced flow operation at low speeds, where volumes are above theoretical capacity. Operations within the queue are characterized by stop-and-go waves and are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion. (Volume to capacity ratio greater than 1.0)

Source: Transportation Research Board, Highway Capacity Manual: Special Report 209, Washington, D.C. 1985.

FIGURE 1 ***(continued)***

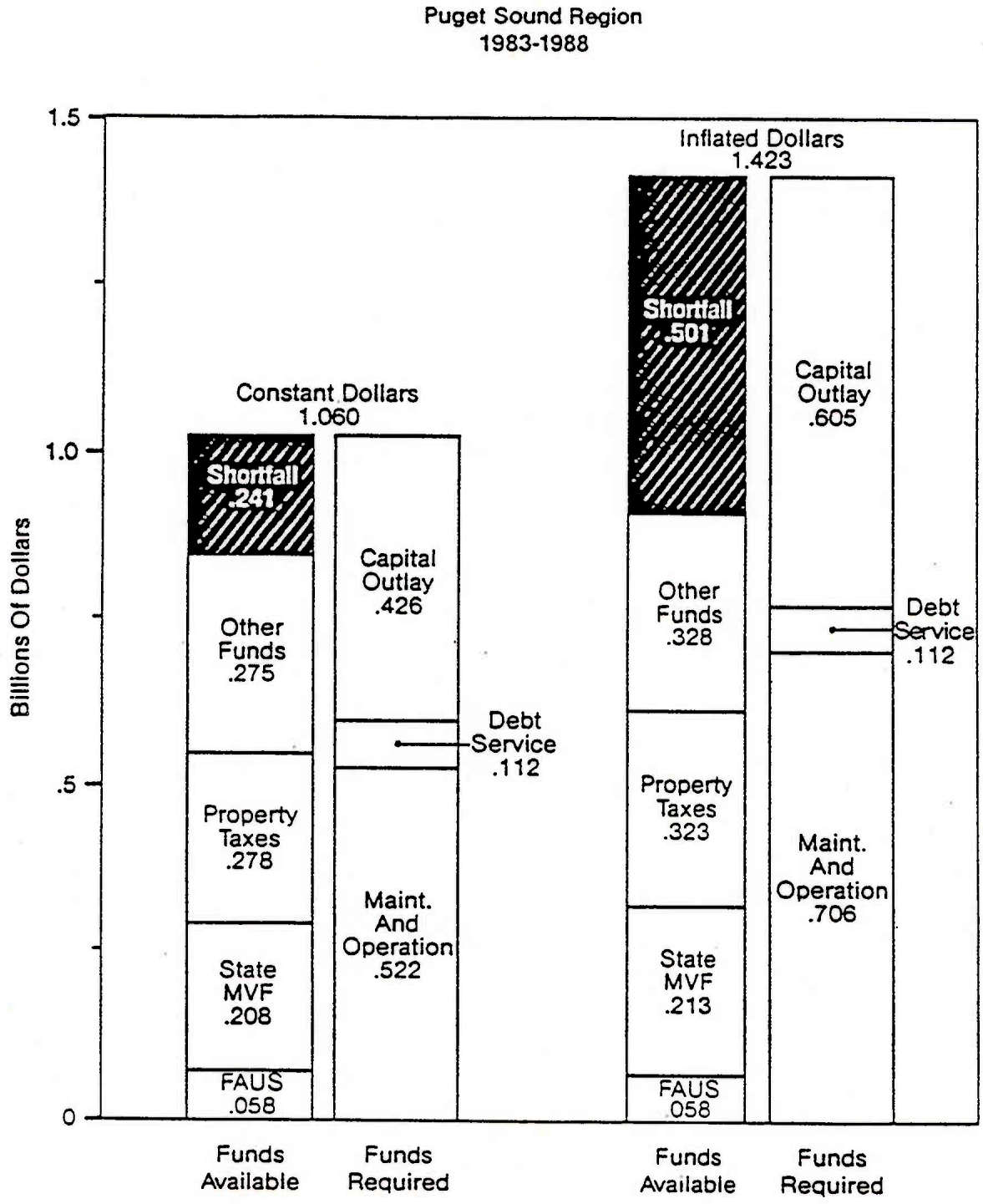
For King County, high priority road improvements through 1990 are estimated to be in excess of $200 million.[17] The current 1984-89 Capital Improvement Program of approximately $90 million will only address about 45 percent of the identified needs.[18] By contrast, ten years ago there was a very minimal funding shortfall. The funding shortfall for local roads and streets in the Puget Sound region as a whole for 1983-1988 is shown in Figure 2. Expenditures for local roads and streets within King County during the past 20 years are shown in Table 2.

TABLE 2

CAPITAL OUTLAY FOR LOCAL ROADS AND STREETS WITHIN KING COUNTY: 1965 - 1984
(In millions of dollars, based on 1985 dollars)

1965	$ 94.2
1970	152.7
1975	143.0
1980	144.9
1984	157.8

Source: PSCOG, Regional Transportation Plan Financial Element, February 1983.



Source: PSCOG, Regional Transportation Plan Financial Element, February 1983, p. 51.

FIGURE 2
Funding Shortfall for Local Roads and Streets

C.Transit/Rideshare Mode Split

The important role of public transportation in accommodating regional travel demand is recognized in both the Puget Sound Council of Government's (PSCOG's) Regional Transportation Plan (September 1982) and the King County Comprehensive Plan (April 1985). The Regional Transportation Plan for the Central Puget Sound Region states:

> With the categorical constraints imposed on expansion of the freeway-expressway system, the solution to the transportation needs in major regional corridors has to depend on strategies directed toward an increase in transit mode-split and vehicle occupancy, especially during the peak periods.[19]

King County's Comprehensive Plan recognizes that:

> High quality transit can be superior to the private automobile in public and private capital and operating costs, and in consumption of land, materials, and energy, if residential and employment densities are high enough to support significant transit use... The King County Comprehensive Plan calls for development patterns in Urban Areas that will support good transit, which in turn will provide better service to planned growth.[20]

Although 1980 transit usage accounted for a relatively small percentage of region-wide travel (3.9 percent of total trips, 1.7 percent of non-work trips, and 9.7 percent of home-to-work trips), transit was much more important in those portions of the region with high-density development.[21] The focal point of transit usage is the Seattle Central Business District (CBD), where transit serves over 40 percent of peak hour work trips.[22] Table 3 shows estimated transit mode splits for selected Seattle area communities in Metro's service area.

By the year 2000, transit's share of total trips is projected to increase to 6.0 percent, while the percentage of work trips by transit is projected to increase to 11.0 percent.[23]

As the planned high occupancy vehicle lanes on the state highway network in the Seattle metropolitan area near completion, the role of ridesharing will also grow in importance. Even a small increase in auto occupancy can have a significant effect on peak period congestion. For example, the total peak

TABLE 3

ESTIMATED 1980 TRANSIT AND RIDESHARE WORK TRIP MODE SPLIT FOR SELECTED SEATTLE AREA COMMUNITIES

	Transit Trips (%)	Carpool/Vanpool Trips (%)	
		(2 person)	(3+ person)
Seattle CBD	43.5	23.6	7.6
Duwamish	6.9	17.2	11.1
University Area	23.2	12.5	4.3
Tukwila-Kent	1.9	15.5	5.4
Renton	2.3	15.9	7.0
Bellevue CBD	4.9	11.4	2.3
First Hill	17.6	14.6	4.1
Sea-Tac	2.6	11.9	3.6
Northgate	4.1	13.0	4.0

Source: U.S. Bureau of the Census, Journey-to-Work Data: Origin of Home-to-Work Trips by Forecast Analysis Zones, 1980.

hour auto occupancy level in the city of Kent is about 1.2 persons per vehicle. PSCOG's forecast for 2000 is 1.46 persons per vehicle for total peak hour travel. If this 25 percent increase in the vehicle occupancy level were achieved for north-south travel crossing the northern study area boundary (176th/180th Streets and Petrovitsky Rd.) it would eliminate the 5-10 percent capacity deficiency that was estimated using current occupancy levels.[29] The estimated 1.06 volume/capacity ratio for screenline EW-1 (north of S. 180th St.) would decrease to about 0.85 (from LOS F to LOS D).

If the projected increase in HOV usage does not occur, the demand on the regional highway system will become extremely critical. As an illustration, the difference between having an average vehicle occupancy of 1.38 and 1.44 in the year 2000 would create a demand for three additional lanes of freeway traffic during the peak hour for 12 miles.[30] At four million dollars per urban freeway lane-mile, this would amount to $144 million. This figure is based on an assumption of 6,000 additional vehicle trips in the peak hour.

It should be noted that average vehicle occupancy (AVO) may have actually decreased since 1980, however. Data collected at 47 employment sites throughout the region in 1985 showed the average AVO to be down from 1.38 persons per car in 1980 to 1.10 persons per car.[31] Sites that had transportation management programs had significantly higher ridesharing rates than sites without such programs.

REFERENCES

Section 1: The Role of Public Transportation

1 C. Kenneth Orski, "Suburban Mobility: The Coming Transportation Crisis?", Transportation Quarterly, Volume 2, No. 2, April 1985, p. 285.

2 Robert Cervero, "Managing the Traffic Impacts of Suburban Office Growth," Transportation Quarterly, Volume 38, No. 4, October 1984, p. 538.

3 Ibid., p. 538.

4 Op Cit., "Suburban Mobility: The Coming Transportation Crisis?", pp. 285-287.

5 Ronald J. Fisher, "Megatrends in Urban Transport," Transportation Quarterly, Volume 38, No. 1, January 1984, p. 97.

6 Ibid., p. 89.

7 King County Department of Planning and Community Development, 1986 Annual Growth Report, p. 5.

8 Ibid., p. 5.

9 Ibid., p. 3.

10 Ibid., p. 6.

11 Ibid., p. 6.

12 City of Bellevue, Transportation Element of the Comprehensive Plan, October 1983, pp. 21-22.

13 TDA, Inc., University District Transportation Program: Projected Future Conditions (Baseline)

14 King County Planning Division, North Soos Creek Plateau Study, December 1981, p. 49.

15 Interview with Bob Sicko, Transportation Planner, PSCOG.

16 Interview with Ted Rosinbum, Transportation Planner, PSCOG.

17 Op Cit., 1984 Annual Growth Report, p. 225, updated by Bill Hoffmann, Chief, Transportation Planning section, King County Department of Planning and Community Development.

18 Ibid., p. 225.

19 Puget Sound Council of Governments, Regional Transportation Plan, September 1982, p. 90.

20 King County Comprehensive Plan, April 1985, p. 119.

21 Op Cit., Regional Transportation Plan, September 1982, p. 55.

22 Ibid., p. 55.

23 Ibid., Bob Sicko.

24 Ibid., Bob Sicko.

25 Ibid., Bob Sicko.

26 Ibid., Bob Sicko.

27 Ibid., Bob Sicko.

28 Op Cit., Regional Transportation Plan, p. 90.

29 Wilsey and Ham, City of Kent Transportation Study, Task Three: Travel Forecasts, October 1982, p. 67.

30 Interview with Jerry Schutz, Planning and Research Engineer, Washington State Department of Transportation, October, 1985.

31 Puget Sound Council of Governments, Alternative Access Modes Database Project, May 1986, p. 16.

Section 2:
Factors Considered in Planning Public Transportation Services

I. THE PUBLIC TRANSPORTATION MARKET

In planning public transportation services, Metro tries to provide King County residents with a wide range of transportation options.

Metro's public transportation market consists of transit passengers, carpoolers, vanpoolers, and paratransit users.

King County area commuters do not always use the same mode of transportation every day, but change modes, depending on individual circumstances. When bus riders commute home by a different mode than they used to get to work, they are almost equally likely to carpool or drive alone.[1] Carpooling is the mode used next most frequently by single occupant vehicle drivers, and the bus is HOV commuters' alternate mode.

The factors involved in planning transit service are much different from those involved in planning ridesharing services. The primary points on which the two differ are listed below:

- o Target market - While ridesharing is aimed at a commuter market, transit service is designed to provide mobility for midday, evening, and weekend riders (where justified by population density), in addition to commuters.

- o Flexibility - Carpools and vanpools can be tailored to the schedules, origins, and destinations of individual riders, while transit service cannot deviate from a specific route, unless operating in a demand-responsive mode.

- o Density - Carpooling and vanpooling are much more suited to low-density, suburban areas than fixed-route transit (although suburban areas can be served successfully with transit service from park-and-ride lots.)

- o Cost - The major portion of the cost of operating carpools and vanpools is normally borne by the riders, while less than one-third of the cost of operating transit service is borne by transit passengers. Also, transit service is much more expensive to operate than carpools or vanpools because paid transit operators are required.

- o Personalization of service - Although transit service may be scheduled to serve particular shifts at individual companies, it does not involve personalized service to individual riders, as ridematching does.

A. Transit Service Demand and Bus Route Planning

1. Overview

Frequently, planners are asked why bus routes are continually changed and expanded. The primary answer is that the urban area itself is always in a constant state of change. The financial health and productivity of the transit system depends on keeping apace with this process of growth. Alterations in service patterns usually reflect changes in ridership due to such factors as:

- o population growth or decline
- o development of new employment centers, schools, or residential areas
- o ability to operate on new streets or expressways

A secondary reason for altering service is that ridership does not always develop as anticipated by planners. Until the establishment of Metro Transit in 1973, transit operators in the Seattle area had neither the public mandate nor the financial resources to keep pace with the growth in travel demand. Public transit had suffered a continuously declining share of the area's travel market since the end of World War II, the bus route network was obsolete in some older Seattle neighborhoods, and many developing suburban communities had no service whatsoever.

Metro developed ten-year comprehensive plans with the goal of reaching specific ridership targets in 1980 and 1990, based on year-to-year improvements in service and facilities. However, because of the fluctuating nature of the regional economy and the lack of comprehensive regional land-use controls guiding the location of activity centers, planners and policy-makers have had to adjust the transit system to actual transportation needs.

2. Forecasting Transit Demand

Provision of transit service to a local community is dependent on:

- o the vitality of its activity centers
- o residential patterns and densities
- o socio-economic characteristics of the population, including auto ownership, income, employment status and sex of the traveler
- o the location of residences, shops, schools and employment areas
- o travel patterns
- o the ease or difficulty of circulation and parking
- o the ease of bus access, as determined by the street network
- o the pedestrian environment.

High densities, concentrated travel corridors, topographic barriers, a growing economy, and strong central areas result in high ridership while low densities, dispersed development, and weak central areas have the opposite effect.

Table 4 shows population densities for selected East King County jurisdictions. 1980 population densities ranged from 2.0 households per acre in East Sammamish to 8.3 households per acre in Kirkland. Seven dwelling units per acre has been suggested as a threshold for supporting local transit service. If households are considered to be the equivalent of dwelling units, all but one Eastside area in Table 4 fell below this threshold in 1980. The low population densities in the suburbs can be contrasted with some 1980 Seattle population densities, e.g. U-District--

14.6 households per acre, Capitol Hill (13.3), Ballard (10.7), Columbia/Rainier Beach (8.2), Northgate (7.5), and West Seattle (8.7).

For short-range operations planning, transit demand is usually gauged by the recent ridership trends and population and employment growth in the planning sub-area. King County and local jurisdictions are good sources of short-range data on these key indicators. The Puget Sound Council of Governments also issues Small-Area Forecasts of Population and Employment, a compilation of historic trends and future projections calculated by Local Planning Area. The future forecasts show population and employment by 10-year intervals. Direct contacts with large firms locating in the sub-area are also valuable, as they can provide information on the residential distribution and general characteristics of their work force.

Route planners try to keep abreast of proposed development through the environmental review process. When a new major employment site is about to locate within the service area, the planners will work to determine potential employee commute patterns as early as possible. Bus service extensions and changes typically follow employment and population rather than leading development. Because mode choice is most volatile when individuals are changing their commute patterns, it is important that service be provided in advance of new development whenever feasible.

For smaller suburban centers, information on employee commute patterns may be crucial in determining whether transit demand is at the "threshold" level necessary to begin service. The "threshold" is the level of ridership necessary to achieve acceptable peak hour productivity on a route that has a minimum of three one-way peak hour trips. For example, a suburban office park with 1,000 employees can expect a minimum transit mode split of about 2 percent (20 people).[3] Three times that number of riders would be required at a minimum for new service.

TABLE 4

LAND AREAS AND POPULATION DENSITIES FOR SELECTED EASTSIDE AREAS

PSCOG FORECAST AND ANALYSIS ZONE	LAND AREA IN RESIDENTIAL ACRES		POPULATION		AVERAGE HOUSEHOLD SIZE (PERSONS PER HOUSEHOLD)		DENSITY (HOUSEHOLDS PER ACRE)	
	1970	1980	1970	1980	1970	1980	1970	1980
Issaquah	253	495	4,200	6,328	2.34	2.61	7.1	4.9
East Bellevue	1,058	1,700	23,023	24,583	3.37	2.79	6.5	5.2
Kirkland	878	1,095	18,911	22,851	3.02	2.50	7.1	8.3
Redmond	374	1,222	7,147	15,194	5.47	2.82	3.5	4.4
East Sammamish	417	2,048	5,978	12,673	3.22	3.06	4.4	2.0
Mercer Island	1,373	1,700	19,819	21,527	3.37	2.85	4.3	4.4

Source: PSCOG, Population and Employment Forecasts (March 1984)

When the threshold for providing transit service is not reached, Metro has a range of services available to encourage ridesharing at a work site. For a discussion of these programs, see part B.

3. Operations Planning

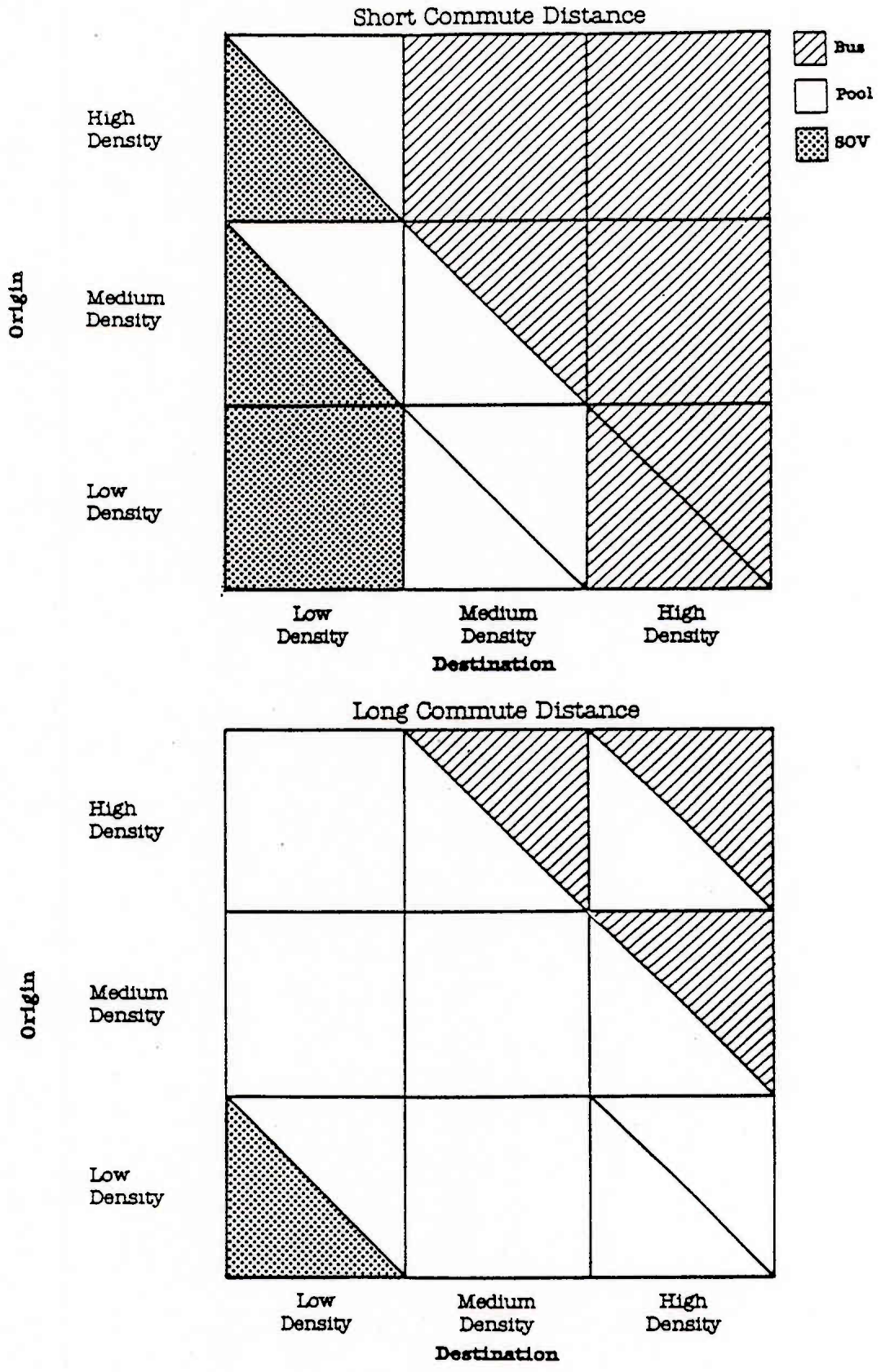
Once general travel "desire lines" are known in a given sub-area, planners must examine the existing transit network, if there is one, and the street and highway system to determine the practicality of reorienting service to better meet the actual travel demand. Often, the constraints to achieving this objective are formidable. Past operating practices, existing ridership orientation, budget limitations, street patterns and even the availability of on-street bus layover space can influence or limit the degree to which service can be modified. In addition, the service must be designed so that it is clear and understandable to the public; changes must be coordinated with other planning and public works agencies to expedite bus flow and to ensure that streets in nearby developing suburban areas are able to accommodate buses.

B. Determining the Market for Ridesharing

As shown in Figure 3, transit generally works best between areas of high or medium density and close proximity, while vanpooling and carpooling are better suited to markets involving high to medium densities, long distances, or people with atypical commute patterns.

It is estimated that of the 56.5 percent of all commuters who drive alone to work, 38 percent could and would rideshare under the right conditions.[8] (That represents 21.5 percent of all commuters).[9]

Metro provides a variety of supportive services designed to promote ridesharing. These include:



Source: 1990 Ridesharing Plan--King Subregion, May 1982.

FIGURE 3
Transit and Rideshare Markets

- Ridematching services - Applications by individuals to provide transportation or join another vehicle for commute trips are matched with other applicants in a centralized computer file for the purpose of encouraging multiple-person vehicle trips to and from the same general area and time periods.

- Vanpool services - Vanpool services include the administration of the Metro vanpool program, the management of VAN (Vanpool Association Northwest), and the provision of information and assistance to the administrators of local employer or developer sponsored vanpool programs.

- Employer involvement program - This includes the marketing of services and programs to employers and their employees.

- Destination parking management program - Such programs are developed where requested by an employer or local jurisdiction with parking problems. They involve problem identification and analysis, and recommending solutions and methods for evaluation. Typical products could include priority parking plans for HOVs, demonstration programs for carpool certification and recommendations for promotion, signage and/or HOV subsidies.

- Developer involvement program - This program assists a developer in defining a transportation management plan in response to requirements of the local jurisdiction for the purpose of mitigating traffic impacts to and from the project site.

- Flexible working hours/Flex-time - This involves working with employers on the scheduling of employee work periods to encourage commuting other than during peak traffic hours. Flex-time can assist in relieving traffic congestion and facilitate travel by HOV modes.

- Origin parking program - Origin parking programs include the development and administration of a leased park and pool/ride commuter

parking lot system, and parking management activities with developers, jurisdictions, or employers for origin based commuter parking facilities.

- Custom or "subscription" bus services - A custom bus is typically commuter-oriented, operating fixed routes and schedules tailored to the travel times and patterns of "subscribers." The service is open to the general public. Routes are usually over 10 miles in length and serve locations normally unable to support regular bus services.

Metro has Commuter Service Representatives assigned to specific geographic districts who contact large employers to assist with establishment and ongoing support of company sponsored rideshare and transit programs. The responsibilities of Commuter Service Representatives include training of new Employee Transportation Coordinators, attending community and business organization meetings, and assisting companies with surveys of employee commute modes.

Local jurisdictions can support transit and ridesharing activities by:

- Reducing parking requirements for new development projects, in combination with rideshare programs;
- Requiring or increasing charges for parking;
- Requiring development to participate in or provide rideshare programs or improved access to transit;
- Providing for passenger load facilities in dense employment locations.

References

Section 2: Factors Considered in Planning Public Transportation Service

1 GMA Research, Metro Attitude and Awareness Study, December 1985, pp. 70 and 72.

2 Boris S. Pushkarov and Jeffrey M. Zupan, Public Transportation and Land Use Policy, 1977, p. 140.

3 Interview with Mike Bergman, Transit Planner, Municipality of Metropolitan Seattle.

4 Puget Sound Council of Governments, 1990 Ridesharing Plan - King Subregion, May 1982, p. iii.

5 Ibid., p. iii.

6 Ibid., p. iii.

7 Ibid., p. iii.

8 Ibid., p. iii.

9 Ibid., p. iii.